2013

Spatially Explicit Management Recommendation for Early Successional Bird Communities on Department of Defense Lands in the Mid-Atlantic Region.

M. D. Wilson
The Center for Conservation Biology

B D. Watts
The Center for Conservation Biology, bdwatt@wm.edu

Department of Defense
Legacy Resource Management Program

Project Number 08-2-0005

Spatially Explicit Management Recommendation for Early Successional Bird Communities on Department of Defense Lands in the Mid-Atlantic Region

Michael D. Wilson
Bryan D. Watts
Center for Conservation Biology
College of William and Mary and Virginia Commonwealth University

July, 2013

Spatially Explicit Management Recommendation for Early Successional Bird Communities on Department of Defense Lands in the Mid-Atlantic Region

Michael D. Wilson
Bryan D. Watts
Center for Conservation Biology
College of William and Mary and Virginia Commonwealth University

Recommended Citation: Wilson, M. D., and B. D. Watts. 2013. Spatially Explicit Management Recommendation for Early Successional Bird Communities on Department of Defense Lands in the Mid-Atlantic Region. Center for Conservation Biology Technical Report Series: CCBTR-13 - 002. Williamsburg, VA.

Project Funded by the United States Department of Defense Legacy Resource Management Program

The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

Abstract

Populations of many of the bird species that depend on early successional habitat in the mid-Atlantic region are declining and of conservation concern. The United States Department of Defense supports more open, early successional habitat than any other government agency in the region. Large, open grasslands and shrublands are regularly maintained on DoD installations for military missions such as airfields, firing ranges, armored vehicle maneuvering, and other purposes. However, not all open patches have the same flexibility for management due to requirements of the military mission. This assessment was conducted to determine the capacity and management flexibility of DoD installations to provide habitat for grassland and shrubland birds.

A status assessment of early successional habitats on DoD lands was conducted by delineating individual patches of grassland and shrubland habitats from aerial imagery. Results of this assessment indicate that DoD installations support 1,223 patches of early successional habitat patches totaling 23,149 ha (57,178 acres). Projected estimates suggest that these patches can potentially support 213,000 pairs of breeding grassland and shrubland birds.

Grassland and shrubland birds occupy distinctly different habitats due to differences in their overall habitat requirements. Grassland birds require open patches composed of only grasses and forbs and respond negatively to woody plant intrusion. Most grassland bird species are also sensitive to habitat area and found more frequently in large patches compared to smaller patches. Shrubland birds use later stages of open field succession and require woody vegetation in the form of shrubs and sapling trees. Shrubland birds are not as sensitive to habitat area as their grassland species counterparts and often found in small patches, along forest edges, and at canopy caps if dense shrub vegetation is present.

Conversion of small grassland patches to shrublands is one recommended management scenario that can be broadly implemented across DoD installations to increase the overall land holding capacity of for early successional birds. This conversion allows small patches that represent poor habitat for grassland birds become quality habitat for shrubland birds. However, because small grasslands are not that common across DoD installations relative to other early successional habitats, this shift in management would only increase populations of shrubland birds by 2% of the current estimate.

A comparison between 1996 and 2012 indicated relatively little change in the availability of early successional habitats on DoD installations. DoD lands provide some of the most expansive and stable patches of habitat for early successional birds of conservation concern in mid-Atlantic region.

Introduction

In 1991, DOD through each of the military services joined the Partners in Flight (PIF) initiative. Through this partnership, DOD has committed to integrate neotropical migratory bird management efforts into existing natural resource and land management programs that are consistent with the military mission. Because of the high concentration of military installations within the Mid-Atlantic region, DOD lands have the potential to play a significant role in the conservation of declining bird populations.

Maintaining threatened ecosystems and restoring declining population levels of high concern species is the greatest conservation challenge faced by land managers within the Mid-Atlantic region. The natural landscape of this region has been dramatically altered for nearly four centuries resulting in shifts in the availability and distribution of habitats from anthropogenic uses. Due to their broad dissemination and regional abundance, government-managed lands represent one of the most promising opportunities to preserve biological communities in the face of urban development. However, government-managed lands are represented by tens of thousands of individual habitat patches spread over multiple agencies and hundreds of managers with a diversity of programmatic directives. Moving this patchwork of lands forward to achieve a regional conservation goal will require orchestration of management activities over a large scale.

The U.S. Department of Defense manages extensive land holdings in the mid-Atlantic region that provide habitat for a diverse suite of species that are of conservation concern within the region. A prominent feature of DoD installations are the large open habitats as a result of military training activities (Figure 1). Open habitats on DoD installations are maintained in an early successional state as grassland or shrublands through frequent mowing or burning. These habitats support a suite of bird species that depend on grasslands or shrublands for breeding, wintering, and migratory habitat. Bird species associated with grasslands and shrublands have experienced population declines that in many cases are equal to or greater than forest-dwelling birds and other habitat suites. According to the USGS Breeding Bird Survey, 28 species associated with these early successional habitats in the eastern United States have showed negative population trends over the past three decades. Although reasons for these declines may be many, the most pervasive explanation is that the availability of habitats to support these species has dramatically declined.

The DoD manages more area of open, early successional habitat than any other individual public agency within the region (Figure 2). Moreover, DoD installations also support the greatest preponderance of large open habitat patches. Many grassland birds are found only in large grasslands and not in small ones making the DoD the unique custodians of grasslands that repeatedly meets the special area requirements of open-habitat management scenarios to early successional bird species across the DoD

installations within the mid-Atlantic region that are compatible with the military mission.

Figure 1. Early successional habitats, such as grassland and shrublands are prominent features of the U.S. Department of Defense military installations and account for 16% of the the DoD landcover within the mid-Atlantic Region.

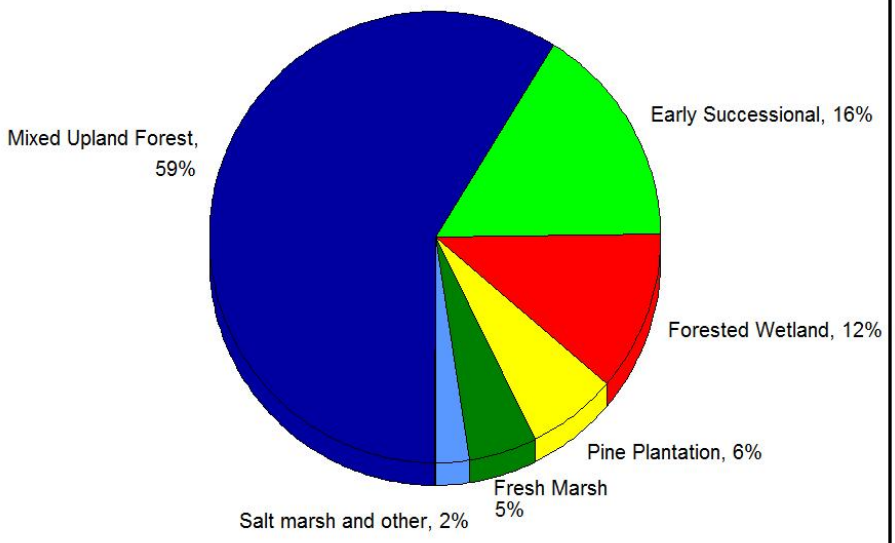
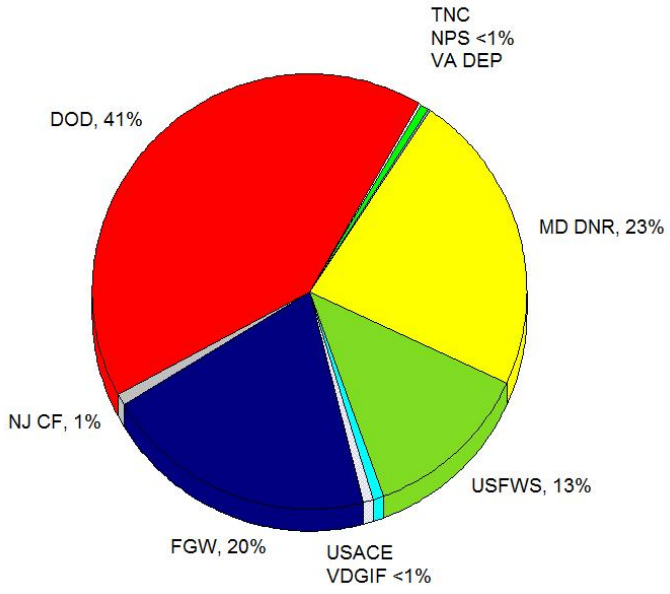


Figure 2. The Department of Defense maintains the greatest percentage of open, early successional habitat among the various agencies in the Mid-Atlantic Region.



Grasslands and Shrublands within the mid-Atlantic Region

Grasslands are open lands dominated primarily by grasses and grass-like plants. Shrublands are open lands with a relatively high coverage of short, woody vegetation such as shrubs and sapling trees. Historically, grasslands were not a significant component of the mid-Atlantic region and were only maintained in small, fragmented patches that were embedded in a much larger forest landscape by Native Americans. Open lands increased dramatically following European settlement, reaching their greatest coverage in the 19th century, as forest lands was cleared for agriculture and other uses. Since that time, the availability of open lands has greatly declined due to secondary succession of cleared lands, reforestation of managed lands, and urban sprawl. As this trend continues, an increasing proportion of remaining open lands become fragmented into small, isolated patches. The majority of open habitats are ephemeral so are not sustained unless there is a stable yield of open habitats being created elsewhere in the landscape. Large open habitats appear to be maintained for longer amounts of time but they have become increasingly rare.

Today, prominent grassland and shrubland habitats in the mid-Atlantic region are derived from agricultural fields and pasture land. Other grasslands occur at airport fields, parks, and urban areas. Shrublands generally occur in utility right-of-ways, regenerating pine plantations, forest blowdowns, and other later successional idle patches. Some of the most extensive and significant open habitats are located on DoD lands.

Cleared lands that are left fallow will naturally undergo succession from grassland to shrublands that eventually give way for forests. Long-term maintenance of open lands requires disturbance of that natural succession through fire or mechanical disturbance. The rate of disturbance therefore determines the field condition. Management of open habitats on relatively short rotation schedules (less than 2 years) will produce grassy conditions suitable for many grassland-dependent bird species. Longer rotation schedules will produce shrubby vegetation that provides habitat for species requiring later successional habitats.

Grassland and Shrubland Bird Populations

Within the mid-Atlantic region, early successional habitats support a diverse assemblage of birds that are resident throughout the year, or present only during the breeding, wintering, or migration seasons. The bird species that inhabit open habitats exist within finite period across the successional vegetation gradient based on their affinity for either grassy or woody conditions. As a result, grassland and shrublands support markedly different bird communities. The grassland bird community is composed of species that require dense stands of bunch grasses and forbs with little intrusion by woody vegetation. They will abandon sites when woody cover becomes intolerable. For some species this occurs around 10-20% shrub cover. The shrubland bird community is comprised of species that require woody vegetation in the form of

dense shrubs and tree saplings. Shrubland bird communities are generally more diverse than their grassland counterpart. This is due, in part, to a natural positive relationship between habitat complexity and the number species it provides. Shrubland birds will abandon sites as trees begin to close the canopy but can colonize forest edges and some forest canopy gaps if dense understory vegetation is present.

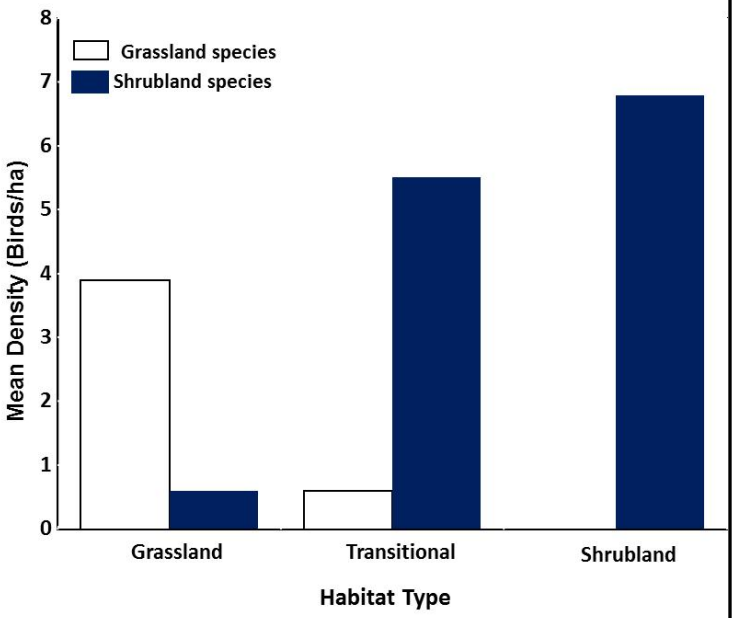
Both grassland and shrubland species respond to finer scale vegetation changes in their respective habitats. Conditions required by grassland birds may only be available for 1-3 yrs without management intervention. For grassland birds, grass height and litter cover can modify whether or not and individual species can occupy a habitat patch. Species such as Horned Larks and Killdeer require the shortest grass height and patches of bare ground. Because of this, Horned Larks and Killdeer typically use grassland patches such as airfields and artillery firing-points because those areas are frequently mowed or burned many times per year. These species avoid sites with taller grasses or sod-forming grasses. Grasshopper Sparrows and Eastern Meadowlarks use

Table 1. List of selected grassland and shrubland bird species that breed in the mid-Atlantic region.

Grassland Species	**Shrubland Bird Species**
Northern Harrier	Brown Thrasher
American Kestrel	Gray Catbird
Northern Bobwhite	Loggerhead Shrike
Killdeer	White-eyed Vireo
Barn Owl	Yellow Warbler
Horned Lark	Common Yellowthroat
Eastern Bluebird	Yellow-breasted Chat
Grasshopper Sparrow	Field Sparrow
Henslow's Sparow	Song Sparrow
Eastern Meadowlark	Northern Cardinal
	Eastern Towhee
	Blue Grosbeak
	Indigo Bunting
	American Goldfinch
	Orchard Oriole

Figure 3. Vegetation structure of early successional habitat influences species composition. Grassland birds require grassy vegetation and do not use habitats with woody vegetation. Shrubland birds begin to colonize open habitats when 10% of groundcover are shrubs or small saplings (i.e., transitional habitat). However, denser vegetated habitats become more suitable for more shrubland birds when woody cover is > 30%.

(*Data from Watts et al, 1997*)



habitats with grasses taller than 10cm (4in) can utilize patches with relatively denser grass and litter cover. However, Grasshopper Sparrows are negatively influenced by sod-forming grasses that impede access to the ground. The also avoid grasses when they form dense, tall stands (> 1.5 m, ~5ft) such as typically occurs by monoculture switch grass (*Panicum virgatum*) fields left unmanaged. Grasshopper Sparrows and Eastern Meadowlarks can be found in airfields, drop zones, landing zones, and other impact zones. Species such as the Barn Owl, American Kestrel, and Eastern Bluebird utilize grasslands for foraging but require nesting cavities in the form of a tree, nesting box, or other artificial structure in close proximity.

Shrubland bird species respond to habitat changes more generally compared to their grassland species counterpart. Because of this, they can occupy a greater range of shrubland conditions in the landscape and can also inhabit a single field for a greater time period of its successional history. Although the speed of shrub development in an idle field can vary with many soil conditions, shrublands generally provide habitat for most shrubland birds for 10 or more years. Field Sparrows are one of the first shrubland birds to occupy patches undergoing woody plant succession and will begin to colonize open habitats when woody vegetation covers about 10 % of a patch. Northern Bobwhites can utilize open grasslands when easily accessible from a woodland edge, but

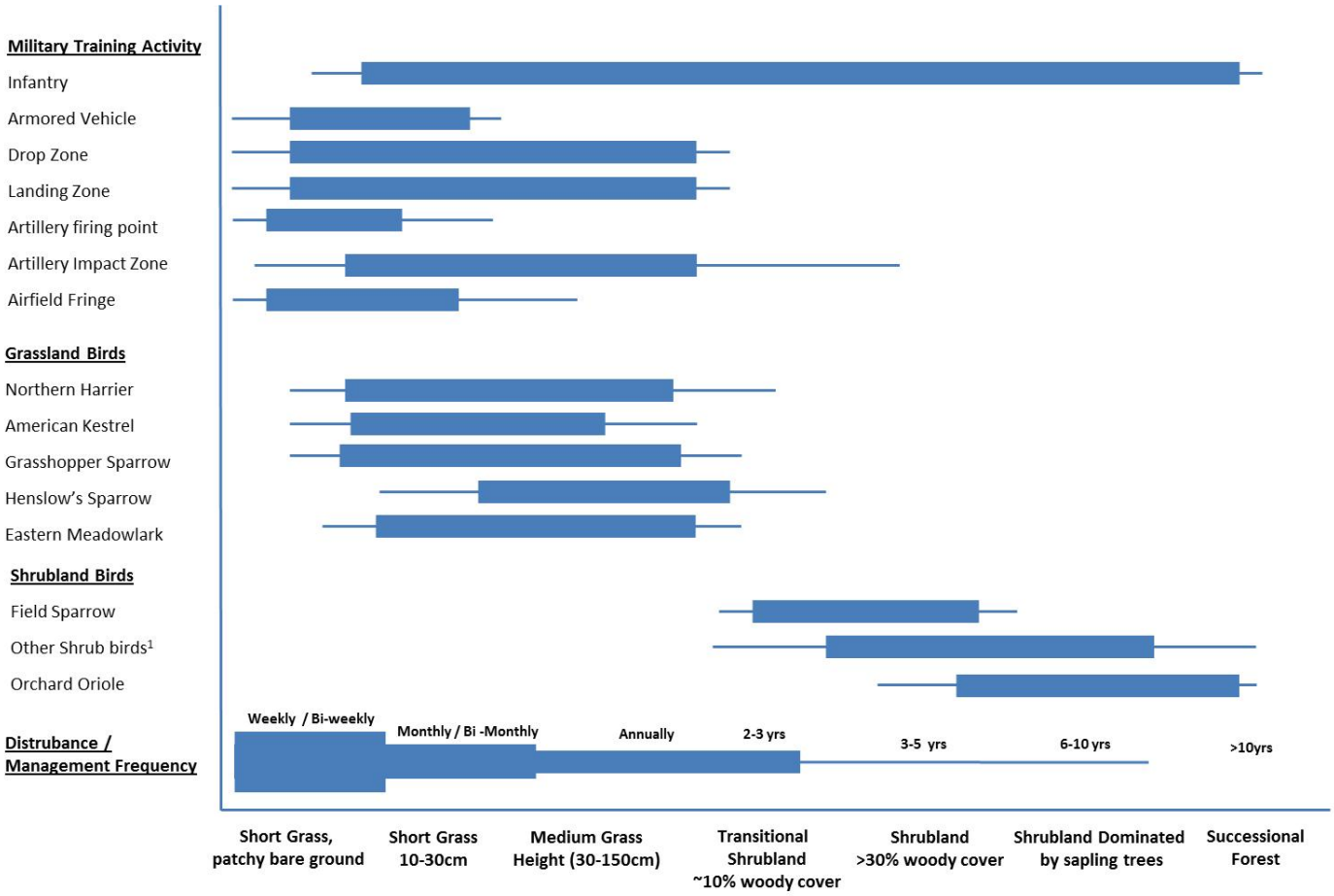


Figure 4. Relationship between military training activities, early successional bird habitat use, and management frequency. Taller bars indicate greater prevalence. [1]See Table 1 for list of other shrub birds.

more frequently use lower density shrub patches when interspersed with grasses. The bulk of the other shrubland species will colonize an open field as it gains more woody cover. Most species can tolerate very dense stands of shrubs and saplings with little or no open space. The Orchard Oriole generally uses later stages of succession as the habitat becomes dominated by taller sapling trees.

Minimum Habitat Area Requirements

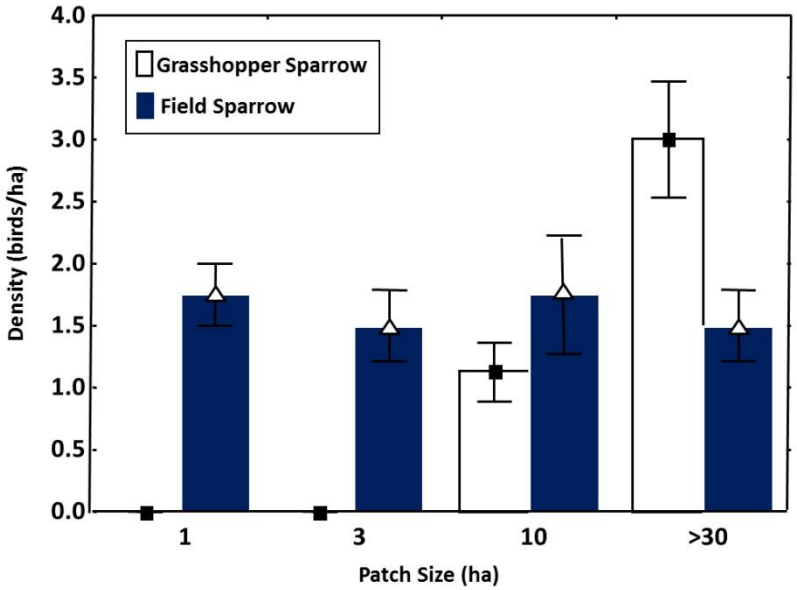
Patch area is an important habitat requirement for grassland species but not as important for shrubland species. This difference in area requirements is particularly important for managers who are conflicted between maintaining individual patches for grassland birds or shrubland birds. Large open patches are relatively rare in a landscape but small open patches are found more frequently. However, the total land cover of large and small patches may be equal when summed at a large spatial scale. leading to the best management solution to manage large patches as grasslands and small patches as shrublands.

Area sensitive species are those more likely to occur in large habitat patches compared to small habitat patches. Although individuals of all species require a minimum habitat area to support their basic life history requirements (such as food or nesting locations), the term area-sensitive is more specifically applied to species that have minimum area requirements that are orders of magnitude greater than an individual's territory size. In the mid-Atlantic region, Grasshopper Sparrows are highly sensitive and require patches that are 10 ha or larger. However, an individual Grasshopper Sparrow may not use more than 1ha. Larger grassland birds such as the American Kestrel, Northern Harrier, and Barn Owl require very large grassland patches of 50-100ha just to meet their territory size requirements. By comparison, shrubland

Figure 5. Relative difference in area requirements between a grassland specialist (Grasshopper Sparrow) in grassy habitat, and a shrubland specialist (Field Sparrow) - in shrubby habitat.

Grassland bird species are sensitive to habitat area and often not found in patches smaller than 10h within the mid-Atlantic region. Shrubland bird species do not show areasensitive patterns.

(Data from Watts et al. 1997)



birds are found in small patches of 1ha or even slightly smaller. Most shrubland species are adapted to using small or narrow habitats that contain dense shrub vegetation such as forest edges, utility right-of-ways, and tree gaps.

Status Assessment and Management Analysis

Department of Defense Lands Assessment

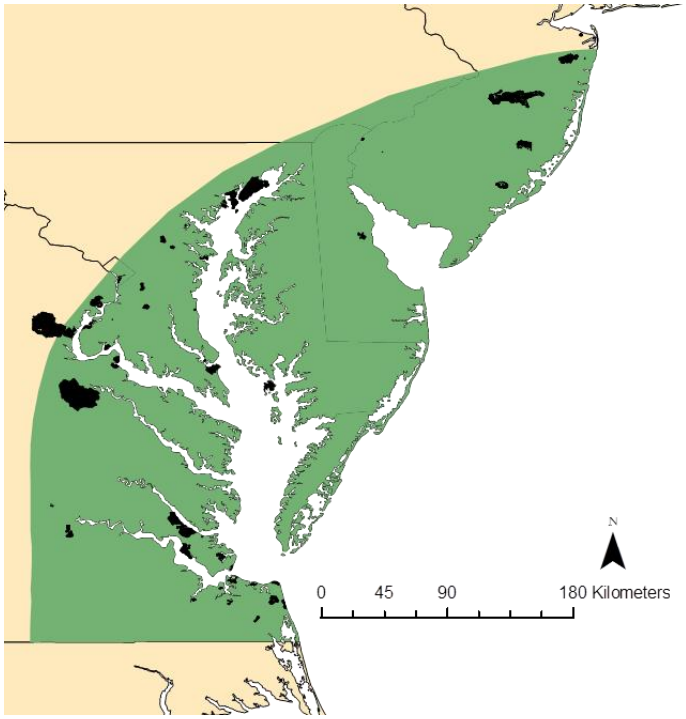
Between 2000 and 2002 an assessment of Partners in Flight partnership lands within the mid-Atlantic Coastal Plain, including those managed by the DoD, was conducted by the Center for Conservation Biology to evaluate the status of priority bird habitats (Watts and Bradshaw 2002). The objective of this project was to summarize a partner by partner stewardship assessment so action plans could be formulated to move bird population habitat objectives among the Partners in Flight collective in an orchestrated manner.

The objectives of the assessment in this report is to 1) identify the location and extent of early successional habitats on DoD lands, 2) conduct a collective evaluation of management scenarios for early successional birds, and 3) develop parcel by parcel management recommendations. The assessment and management analysis is restricted to the DoD installations found within the mid-Atlantic Plain.

Habitat Assessment Methods

Landcover inventory of DoD installations was conducted by interpreting digital orthophoto quarter quadrangles (DOQQs). DOQQs were the only widespread photo material to conduct such a broad analsysis when this assessment was conducted. Source imagery was from 1994 color-infrared with a resolution of 5m. We used ArcView 3.2 (Environmental Systems Research Institute, Inc © 1992-2000) software for all digital processing and interpretation. Digital shapefiles of property boundaries for each installation were superimposed onto DOQQs and habitats were delineated and mapped. Habitats were identified into categories that were considered critical to the conservation of priority bird species in the mid-Atlantic region. These habitats include pine savanna, barrier and bay island, salt marsh, forested wetland, mixed upland forest, early successional, pine planation, and fresh/brackish marsh. Where possible, additional habitat subtypes were included in the assessment. For early successional habitats, additional subtypes included grassland, transitional (10-30% woody cover) and

Figure 6. Distribution of Department of Defense installations in the mid-Atlantic region.



shrubland (>30% woody cover). All habitats were mapped to the patch level. A patch is defined here as a contiguous area of relatively homogenous habitat. Patches were delineated from the surrounding landscape by hard boundaries such as roads, rivers, or homogenous areas of other habitat.

A comparison between the original habitat assessment data and current conditions for all delineated patches was conducted by overlaying the digitized patches on 2012 aerial imagery. This comparison only chronicled changed in the conditions of delineated patches and did not assess any new early successional patches that may have been created over this time.

Habitat Assessment Results

At the time of the original habitat assessment, DoD military installations in the Mid-Atlantic region supported 1,223 patches of early successional habitat patches totaling 23,149 ha (Table 2). Early successional habitats accounted for 16% of the natural land cover of all installations assessed. Individual open patches ranged in size from 0.4 ha to 2,059 ha with an average patch size of 18.9 $\pm$ 83.49 (SD) ha. The overwhelming majority of these patches were < 10 ha (877 of 1,227 patches or 71.5 %)

Table 2. Distribution of grassland and shrubland (including transitionsal) habitats across Department of Defense Installations in the Mid-Atlantic Region.

Installations	Total open habitat (ha)	Patch Size Frequency											
		Grassland						Shrubland					
		≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha	≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha
U.S. Air Force													
Andrews Air Force Bace	613	-	-	-	-	-	2	-	-	1	-	1	-
Langley Air Force Base	603	-	-	-	-	1	3	-	-	-	1	-	-
Dover Air Force Base	941	-	-	-	-	1	2	-	-	-	-	-	-
Boiling Air Force Base	105	1	10	2	5	1	1	-	1	-	-	-	-
McGuire Air Force Base	19	1	3	3	-	-	-	2	3	1	-	-	-
Warren Grove Gunner Range	2,162	-	4	2	1	1	-	3	2	-	2	2	1
U.S. Department of the Army													
Fort Eustis	347	-	4	-	6	11	2	-	-	-	-	-	-
Fort Story	86	-	1	3	2	4	-	-	-	-	-	-	-
Fort Monroe	82	-	1	-	1	-	1	-	-	-	-	-	-
Fort Lee	150	-	-	-	1	1	2	-	-	-	-	-	-
Fort A. P. Hill	3,893	-	8	15	28	20	14	-	-	1	4	7	13
Fort McNair	19	-	1	-	1	-	-	-	-	-	-	-	-
Fort George C. Meade Military Reservation	441	-	7	3	9	8	4	-	2	5	1	1	-

Installation	Total open habitat (ha)	Patch Size Frequency											
		Grassland						Shrubland					
		≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha	≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha
Aberdeen Proving Grounds	4,009	-	1	9	5	15	12	-	-	6	9	9	4
Fort Dix	1,807	50	59	14	17	10	4	50	84	32	21	15	6
Edgewater Arsenal	266	-	-	-	2	4	1	-	2	-	2	4	1
Fort Belvior	198	-	2	-	3	-	3	-	-	-	-	-	-
U.S. Department of the Navy & other													
Curtis Bay General Services Administration Depot	62	-	-	-	-	-	-	-	-	-	-	1	1
Indian Head Naval Surface Warfare Center	36	-	-	3	2	1	-	-	-	-	-	-	-
Blossom Point Proving Grouds	160	-	-	-	-	-	1	-	-	-	-	-	-
Patuxent Naval Air Test Station - Bloodsworth Island	0	-	-	-	-	-	-	-	-	-	-	-	-
Patuxent Naval Air Test Station	1,197	-	11	5	8	11	3	-	5	7	4	6	6
Globecom Monitoring Station	177	-	-	1	2	-	1	-	-	-	-	-	-
U.S. Naval Academy	67	-	4	2	6	1	-	-	1	-	-	-	-

Installation	Total open habitat (ha)	Patch Size Frequency											
		Grassland						Shrubland					
		≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha	≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha
Solomons Naval Surface Warfare Center	66	-	4	-	2	2	-	-	2	-	-	-	-
U.S. Naval Ship R&D	140	-	-	-	6	-	-	-	-	2	1	1	1
Naval Dairy Farm	13	-	-	-	-	1	-	-	-	-	-	-	-
Chesapeake Beach Naval Research Lab	9	-	-	-	1	-	-	-	1	-	-	-	-
Quantico Marine Corp Base	773	-	4	3	5	12	7	-	1	-	3	4	-
Oceana Naval Air Station	1,255	-	-	-	1	1	3	-	-	-	-	1	3
Norfolk Naval Shipyard	172	-	8	4	6	4	1	-	-	-	-	1	-
Yorktwon Naval Weapons Station	213	-	2	-	-	3	1	-	-	1	-	-	-
Little Creek Naval Amphibious Base	66	-	1	2	-	3	-	-	-	-	2	-	-
Yorktown DoD Supply	37	-	-	-	1	2	-	-	-	-	-	-	-
Oceana Naval Air Station - Dam Neck	9	-	-	-	1	-	-	-	-	-	-	-	-
Craney Island Fuel Depot	61	-	-	-	-	1	1	-	-	-	-	-	-
Yorktown Naval Weapons Station - Cheatam Annex	152	4	2	2	2	4	1	-	-	-	-	-	-
Camp Peary	500	-	4	9	6	2	6	-	-	-	-	-	-
Naval Surface Warfare Center, Dahlgren Division	364	-	2	3	2	1	3	-	-	-	-	2	1

Installation	Total open habitat (ha)	Patch Size Frequency											
		Grassland						Shrubland					
		≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha	≤ 1ha	1-3ha	3.1-5ha	5.1-10ha	10.1-30ha	> 30ha
U.S. Naval Shipyard - Portsmouth	10	-	2	-	-	-	-	-	-	-	1	-	-
Norfolk Naval Air Station	328	-	3	5	7	5	1	-	1	5	3	-	2
Norfolk Naval Air Station - New Gosport	9	-	-	1	-	-	-	-	-	-	1	-	-
Norfolk Naval Air Station - St. Julian Creek Annex	51	-	-	2	1	2	-	-	-	1	-	-	-
Norfolk Naval Air Station - Southern Annex	45	-	1	-	-	1	-	-	3	-	2	1	-
U.S. Naval Reservation - Fentress Landing Field	384	-	2	2	5	1	2	-	-	1	1	2	1
U.S. Naval Transmitter Station - Nansemond	250	-	-	-	1	-	1	-	-	-	-	-	-
U.S. Naval Supply Center - Yorktown	39	-	-	-	-	-	1	-	-	-	-	-	-
U.S. Naval Station - Anacostia	56	-	5	3	1	1	-	-	-	-	2	-	-
DoD Ponds (leased near Penns Grove)	33	2	2	1	1	-	-	-	1	-	1	-	-
U.S. Naval Weapons Station - Earl	222	8	4	6	1	2	-	4	12	3	6	2	1
Naval Air Engineering Station - Lakehurst	312	2	12	4	4	4	1	8	13	6	7	3	-
Naval Aviation Facility (Atlantic City Int'l. Airport)	140	-	2	2	1	-	-	1	5	1	1	-	1
Total	23,149	68	176	111	154	142	85	68	139	73	75	63	42

but a number of large patches, > 50 ha, were also identified (N = 80, 6.5 % of all patches).

Most of the larger sized grasslands (> 30ha) were in the form of airfield edges, heavy artillery firing ranges, or armored vehicle maneuvering. Airfield edges and armored vehicle mowing areas are managed regularly by mowing or other mechanical disturbance. For airfields, mowing occurs 1 or more times per month so these areas are perpetually maintained as low-height grasslands. Disturbance on heavy artillery ranges may be at the whim of training frequency unless they are also managed by mowing or prescribed burning. Fires caused by heavy artillery training can often leave burned and unburned areas resulting in a patchwork of vegetation in different successional states over time. In many artillery areas, there is a distinguishable gradient moving downrange where grasslands give way to transitional shrub in the most distal areas from firing points where fires are not as frequent. Other large grassland areas include residential and developed areas that are often in fescue or lawn grass cover. These areas are not suitable for grassland birds and moreover are managed routinely for aesthetic purposes.

Small grasslands (< 3ha) were widely distributed; however most individual installations supported only a few small grassy patches. Fort Dix was the exception to this general pattern by maintaining 109 grassland patches that were < 3ha (Appendix I). This number contributed to 44% of all the small grassland patches found on installations in the mid-Atlantic. At other locations, some small grasslands were adjacent to airfields (e.g., Patuxent Naval Air Test Station) so are continually maintained in a grassy state for air-safety purposes. Other small patches occurred in residential or developed areas. A large number of medium sized grasslands (5-10 ha) appeared to be ammunition depots.

Large shrublands (>30 ha) are found less frequently on DoD installations compared to larger grasslands. Large shrublands appear as areas left idle for forest regeneration, including pine plantations, and also as other training areas without any active management.

Habitat Changes

Over 19,500 ha of the 23,149 ha (84%) of the early successional habitat identified in the original habitat assessment (using 1994 aerial imagery) was maintained under similar vegetation conditions in 2012. The largest change was a transition of open patches to forest over this time (Table 3). This result is not surprising for shrub patches because many shrublands identified in the original assessment could have included regenerating forest areas. A small percentage of patches were lost to development (7 % of total). For grasslands, the turnover of patches to development occurred relatively evenly across all patch size categories. Some of these areas could have been in an open condition during the original habitat assessment because they were slated for

development at that time. However, the majority of grassland patches remained as open grassy habitat across both time frames.

Management Analysis

There are a significant number of open habitat patches within DoD installations in the mid-Atlantic with the potential to support populations of species of conservation concern. However, not all open patches have the same ability because of either their physical characteristics or are inflexible to management because of the requirements of the military mission. Two criteria were used to filter available patches for their compatibility with early successional bird communities. A biological filter was used to determine how candidate patches met the basic requirements for grassland and shrubland birds. A programmatic filter was used to either exclude candidate patches where a change in management would not be appropriate due to conflicts with ongoing land uses for the military mission.

Two characteristics were assessed during the application the biological filter to select open patch recommendations for management of grassland and shrubland birds that include 1) patch size, and 2) patch shape. Due to their requirement for large patches and the general rarity of large patches of grassland habitat in the region, grassland birds were considered of highest priority in patch management decisions. Based on area requirements, patches larger than 10 ha (24.7 acres) are recommended primarily for grassland birds. Patches 1 to 10 ha (2.47 to 24.7 acres) were reserved for shrubland management. Open patches smaller than 1 ha have little value for grassland or shrubland bird communities so were not considered. In general, species that are sensitive to habitat area prefer patches with high amounts of interior habitat rather than patches that are long and thin. Because of this, only open patches with a perimeter to area ratio > 500m/ha were considered to be poor potential habitat and excluded from the candidate list.

Table 3. Change in habitat conditions for individual early successional patches between their original delineation (1994 aerial imagery) to current time (2012 aerial imagery).

Original Habitat Condition	Patch Size (ha)	New Habitat Condition (number of patches) Grassland	Transitional	Shrubland	Forested	Developed	Totals
Grassland	<1	37	0	8	24	1	70
	1.1-3.0	118	0	14	28	21	181
	3.1-5.0	78	0	6	9	10	103
	5.1-10.0	112	1	10	16	19	158
	10.1-30.0	112	0	5	10	15	142
	>30	70	2	2	1	11	86
	All sizes	527	3	45	88	77	740
Transitional	<1	0	0	0	0	0	0
	1.1-3.0	2	4	1	0	1	8
	3.1-5.0	0	9	0	3	0	12
	5.1-10.0	3	17	0	3	2	25
	10.1-30.0	4	20	1	1	1	27
	>30	0	20	2	0	1	23
	All sizes	9	70	4	7	5	95
Shrubland	<1	1	0	26	40	0	67
	1.1-3.0	1	0	40	87	3	131
	3.1-5.0	4	0	24	30	4	62
	5.1-10.0	2	0	27	27	2	58
	10.1-30.0	0	0	22	20	0	42
	>30	0	1	21	6	0	28
	All sizes	8	1	160	210	9	388
All Habitats		544	74	209	305	91	1,223

Management Recommendations

Because small grasslands (< 6ha) provide poor habitat for grassland birds due to their area requirements, and small grasslands do not provide habitat for shrubland birds due to the lack of woody vegetation they require, a principal management recommendation would be to convert small grasslands to shrubland habitat to minimize the lost opportunity of these areas and improve the overall quality of habitat on DoD installations. Using a 6 ha threshold for management can provide an additional 896 ha for shrubland birds (Table 4). However, a change in management is not always possible for every patch due to their programmatic constraints of the military mission. However, based on a subjective assessment of the management potential of each patch it appears that only a few, small grassland patches would be restricted from conversion to shrubland or any other cover type (Table 5). Small grasslands that were not considered available for management generally include those along airfield edges or within residential or office complexes. Other patches likely would be closed to management and better assessed by management staff per installation.

Table 4. Habitat opportunity analysis for grassland and shrubland patches on Department of Defense Installations in the mid-Atlantic region. Small grasslands (< 6ha, shaded gray) provide poor habitat for grassland birds so converting these areas to shrublands will improve their quality for early successional birds.

	Grassland		Shrubland	
Patch Size Category	Number of Patches	Total Habitat Area (ha)	Number of Patches	Total Habitat Area (ha)
<6ha	289	896	215	615
>6ha	342	12,209	186	9,184

Table 5. Management potential for grassland and shrubland patches

		Grassland		Shrubland	
Patch Size Category	Management Potential	Number of Patches	Total Habitat Area (ha)	Number of Patches	Total Habitat Area (ha)
<6ha	Open to management	242	741	204	584
	Closed to management	47	155	11	31
>6ha	Open to management	278	7,485	171	6,815
	Closed to management	64	4,723	15	2,368

Adopting a management regime where all small grasslands are converted to small shrublands produces only a modest change in the capacity of DoD installations to support early successional birds (Figure 6). Projected estimates in bird abundance for this management scenario are an increase of 3,840 pairs of shrubland birds and a decrease of 2,180 pairs of grassland birds. This reflects only a 2 % increase in the population change of shrubland birds on DoD installations in the mid-Atlantic. The only grassland birds negatively affected by patch conversion are those that have small area requirements. The relatively small amount of bird population change by management is related to the low number of grassland patches that exists and the elimination of any patches that cannot be converted due to management constraints (Table 4). Because grassland and shrubland birds are occupying distinctly different habitat types, management to meet requirements of both must be geared to provide a sustained yield of each type over time. Comparisons of the original habitat assessment to current conditions for identified patches suggest little change in the availability of habitats over time. This suggests that DoD installations provide a both a unique quantity and long-term availability of some of the most important early successional habitats in the region. Department of Defense installations in the mid-Atlantic are estimated to support approximately 213,000 pairs of early successional birds including many that are in decline and of high conservation concern.

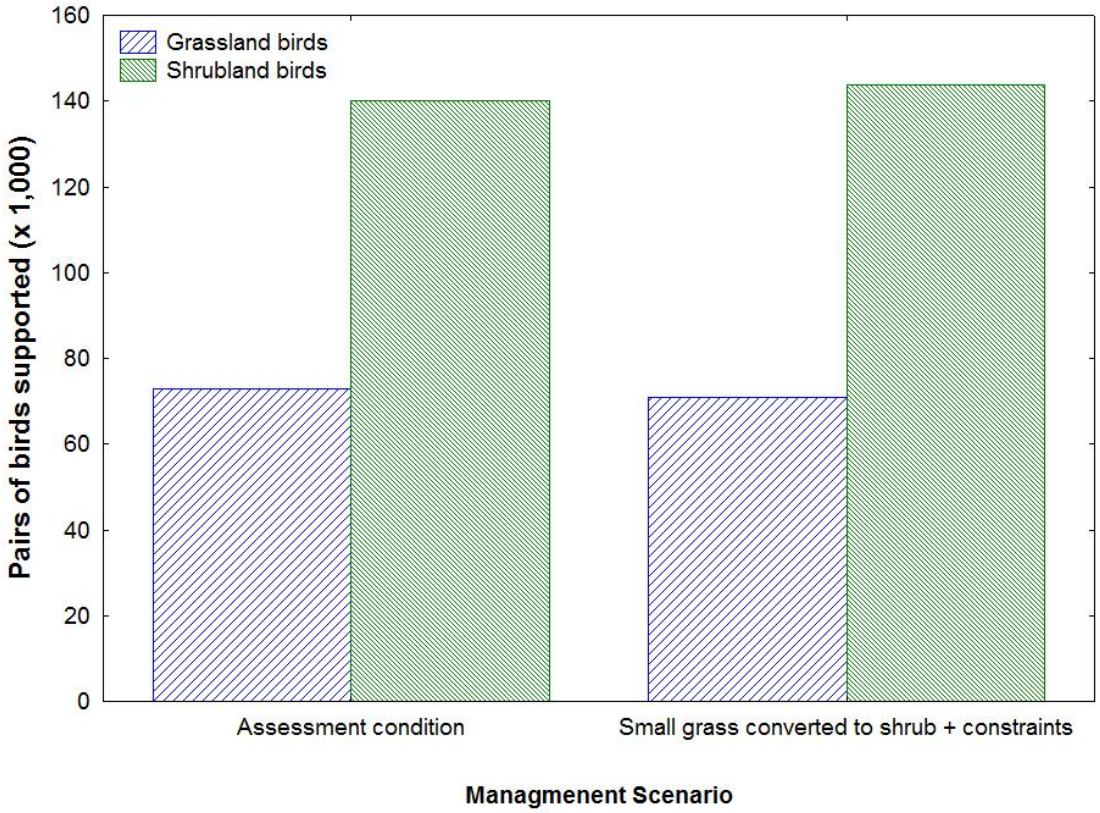


Figure 6. Projected estimates in the number grassland and shrubland birds supported by current management conditions and if an installation-wide management scenario was implemented that would convert all small grasslands (< 6ha) to shrub cover. Projection of grassland to shrubland conversion also takes into account that certain patches cannot be converted due to the needs of the military mission. Overall, implementing a 6ha grass to shrub threshold produces only a small positive result for shrubland birds because the combined area of small grass patches on installations is relatively low compared to larger patches.

Conclusions

1) U.S. Department of Defense installations have extensive landholdings in the mid-Atlantic region that provide habitat for declining bird species are of conservation concern.

2) The U.S. Department of Defense supports the largest percentage of open, early successional habitats required by declining grassland and shrubland birds due to the types of military training missions that occur across these installations.

3) Grassland and shrubland birds occupy distinctly different habitats due to difference in habitat requirements. Grassland birds require open patches composed of only grasses and forbs and respond negatively to woody plant intrusion. Shrubland birds use later stages of open field succession and require woody vegetation in the form of shrubs and sapling trees.

4) Small open patches (< 6 ha) provide poor habitat for grassland birds because they have relatively large area requirements. Shrubland birds are generally less sensitive to area and can occupy small patches of habitat.

5) Management of open patches as grasslands or shrublands can be produced by the interval of time between disturbance such as mowing or burning. Management intervals < 3 years produce grassy conditions required by grassland condtions. Longer intervals allow woody plants to become established and provide habitat for shrubland birds.

6) Small (< 6ha) patches of grassland habitat represent poor habitat for grassland birds and should be considered for conversion to shrubby habitats that are beneficial for shrubland birds.

7) There were relatively little change in the amount and distribution of open lands across installations indicating that the U.S. Department of Defense provides a unique quantity and long-term availability of habitat for declining grassland and shrubland birds that are of conservation concern.

Literature Cited

Watts, B. D., and D. S. Bradshaw. 2002. Evaluating Partners in Flight partnership lands in the mid-Atlantic region: converting conservation plans into conservation actions. Pp 203-207 in Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. Asilomar, CA.

Watts, B. D., M. D. Wilson, and D. S. Bradshaw. 1997. Habitat requirements of early successional bird communities: Management implications for mid–Atlantic region. Center for Conservation Biology Technical Report, CCBTR–97–03. College of William and Mary, Williamsburg, VA.